The Company also utilized two models developed by Telcordia Technologies (formerly known as Bellcore): Switching Cost Information System ("SCIS"), and Common Channel Switching Cost System ("CCSCIS"). Copies of the relevant versions of these models (on CD-ROM) will be provided on request to parties agreeing to a separate confidentiality arrangement.

Q. Has Verizon MA employed any other costing tools in this proceeding?

A. Yes. Verizon has developed a system called VCost.

Q. What is VCost?

A. VCost is an integrated decision support spreadsheet building tool designed to develop consistent, high-quality cost studies in reduced cycle times. It is the result of a series of continuous improvement efforts initiated to refine the cost-development process utilizing a common look and feel as well as a consistency of economic, engineering and computational assumptions. VCost is a spreadsheet building tool that facilitates development of new studies and study updates under differing scenarios. It enables and enhances the analysis of studies across products, jurisdictions, and time.

In addition to being a spreadsheet building tool, VCost contains a repository of commonly used current data. The repository ensures

that the data sources and data are the most current available. The system performs processes such as levelization and inflation in a standard format, thereby promoting consistency and accuracy.

VCost is a client/server application, which resides, in part, on the personal computer of a user and interacts continually with a relational database that resides, relative to most users, on a server in a remote location. The databases contain the formulas and structure of each study defined in the system, common processes, and the data repository mentioned earlier. Finally, VCost will enable the parties to perform sensitivity analyses to assess the impact of modifying various study variables.

Q. How is VCost used to develop the recurring costs that are presented in this filing?

A. As explained more fully in the following section, the general approach to developing the recurring costs in this filing is: (1) determine the investment associated with a given element or service; (2) apply the appropriate loadings to the investment; and (3) calculate the appropriate capital costs and operating expenses associated with the investment. VCost computes the capital costs based on the plant account of the investment and inputs such as Asset Life, Future Net

Salvage, Tax Life, Debt ratio, Cost of Debt, Cost of Equity, and State and Federal Tax rates. The property and other taxes, as well as operating expenses, are computed by extracting the appropriate factors from the database tables and applying them to the investment. The investment is then multiplied by the expense factor. To the annual expense calculated in the previous step, inflation and productivity are applied, where applicable, for each year of the study period. The expense is then levelized over the study period and aggregated to complete the cost development process for that particular investment. Each of these subjects is described fully in the following sections.

Q. Is VCost used to develop all of the costs presented in this filing?

A. No. Certain studies are produced using Microsoft Excel spreadsheets. VCost is, however, used to develop cost factors for these studies. This ensures consistency across all studies.

Q. Can the cost studies being filed using VCost be viewed electronically without loading the VCost system?

A. Yes. VCost has the ability to download any study in either a Word or Excel format. For purposes of this filing, the Company is providing the VCost generated studies within the VCost system to enable the

Department to perform sensitivity analyses using the mechanized features of the VCost system. In addition, the Company is providing the VCost generated studies in Word format, so that they may be viewed electronically without the necessity of loading the VCost system. For illustrative purposes only, we have included the STP Port cost study in Excel version also.

V. BASIC COSTING AND PRICING APPROACH

A. THE COST STUDIES ARE ALL BASED ON LONG-RUN INCREMENTAL COSTS

Q. What costing approach is used for the elements and other services considered in this filing?

A. All of the cost studies included in this filing are based on long-run incremental cost.

Q. What is "incremental cost"?

A. As explained in the FCC's *Local Competition Order*[3]: "Incremental costs are the additional costs (usually expressed as a cost per unit)

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[3] *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, CC Docket No. 96-98, First Report and Order 11 FCC Rcd 15,499 (rel. August 8, 1996), ¶ 675 (footnotes omitted).

that a firm will incur as a result of expanding the output of a good or service. Incremental costs are forward-looking in the sense that these costs are incurred as the output level changes by a given increment. The costs that are considered incremental will vary greatly depending on the size of the increment."

Q. What size increment was assumed in the Company's incremental cost studies?

A. Verizon MA adopted a total service (or total element) approach, in which the increment was the total quantity of the relevant service or element currently being offered. In this respect, the Company's studies are consistent with the FCC's TELRIC methodology (a "total element" long-run incremental cost methodology). Paragraph 690 of the *Local Competition Order* supports this approach: "The increment that forms the basis for a TELRIC study shall be the entire quantity of the network element provided."

Q. What is "long-run" incremental cost?

A. The FCC defines *long-run* incremental cost, for TELRIC purposes, as follows: "In a TELRIC methodology, the 'long run' used shall be a period long enough that all costs are treated as variable and avoidable. This 'long run' approach ensures that rates recover not only the operating

costs that vary in the short run, but also fixed investment costs that, while not variable in the short term, are necessary inputs directly attributable to providing the element."[4] In this type of long-run approach, technology choices are not constrained by any "embedded" technology already present in the network.

Such long-run approaches can easily veer off into attempts to determine the costs of "fantasy networks." Accordingly, even the FCC was careful to limit the TELRIC concept by adopting a forward-looking technology standard based on "the use of the most efficient telecommunications technology *currently available* and the lowest cost network configuration, *given the existing location of the incumbent LEC's wire centers*."[5] Thus, neither speculative future innovations nor changes in wire center locations were to be considered in such a study.

Q. What long-run incremental costing approach is used by Verizon MA in these studies?

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[4] *Local Competition Order* ¶ 692 (footnote omitted).

[5] 47 C.F.R. § 51.505(b)(1) (emphasis supplied); *see also Local Competition Order* ¶ 685.

A. Application of the TELRIC methodology is currently required by the FCC's rules for those network elements that incumbent LECs are required to offer on an unbundled basis under § 251(c)(3) of the Act. Accordingly, we use TELRIC for those elements that are subject to mandatory unbundling under the *UNE Remand Order*. We do so, however, reserving the Company's objections to that methodology. We note that the FCC's TELRIC rules have been invalidated by the United States Court of Appeals for the Eighth Circuit, and the issues are currently scheduled to be heard by the Supreme Court of the United States. Changes in these studies may be appropriate if the Eighth Circuit's ruling is upheld.

However, services such as OS/DA, as note above, are *not* subject to mandatory unbundling requirements, and thus are not subject to TELRIC pricing under the Act.[6]

B. RECOVERY OF COMMON COSTS

Q. What provision is made in Verizon MA's TELRIC studies for the recovery of common costs?

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[6] *See UNE Remand Order* ¶¶ 468-73.

A. The FCC concluded in the *Local Competition Order* that if prices are to be based on incremental costs, they should also include an allocation of forward-looking common costs.[7] The FCC's regulations define recoverable "forward-looking common costs" as "economic costs efficiently incurred in providing a group of elements or services (which may include all elements or services provided by the incumbent LEC) that cannot be attributed directly to individual elements or services."[8] In keeping with these regulations, the Company's TELRIC studies provide for the recovery of an allocable share of such common costs.

Q. How did Verizon MA allocate common costs to particular elements?

A. Since common costs by definition cannot be directly assigned to particular elements, they must be allocated over elements in some reasonable manner in TELRIC studies. Any allocation methodology should ensure that the sum of common costs allocated to various

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[7] *See Local Competition Order* ¶ 694; 47 C.F.R. § 51.505(a).

[8] 47 C.F.R. § 5.505(c)(1).

elements does not exceed the Company's total common costs.[9] The method utilized by the Company, in which common costs are generally included as an Annual Cost Factor ("ACF"), so that such costs in effect "follow" the costs in each element, is consistent with what has long been used by the Company and recognized by this Department as reasonable. (The common-cost ACFs are only used to allocate overhead-type costs that are common to all elements. As is described below, certain costs common to two or more elements (*e.g.*, poles and conduit that are shared by loop and transport facilities are addressed in a different manner.) The specifics of the Company's approach to calculating ACFs to identify and recover common costs are discussed in greater detail below.

C. AVOIDANCE OF DOUBLE RECOVERY

Q. How do Verizon MA's studies avoid double recovery?

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[9] *See* 47 C.F.R. § 51.505(c)(2)(B): "The sum of the allocation of forward-looking common costs for all elements and services shall equal the total forward-looking common costs, exclusive of retail costs, attributable to operating the incumbent LEC's total network, so as to provide all the elements and services offered."

A. The Company's general approach is designed to avoid the inclusion in rates for particular UNEs of costs that are already being recovered elsewhere.

For example, in determining the investment associated with particular elements, the Company determined the investment costs of the discrete, identifiable, separate components comprising those elements. The ability to assign particular investments unambiguously to particular elements is a key factor in avoiding double recovery under total-element costing approaches.[10] In the uncommon case where a single network asset is shared between elements (*e.g.*, sharing of structure between loops and transport, sharing of building and power costs between elements located in the central office), explicit allocation methodologies were used to ensure that only the total cost of the relevant investment was recovered, and no more.

Similarly, Verizon MA's approach to the estimation of expenses, which depends on the application of ACFs, calculated as the ratio of total forward-looking expense (excluding retail expense) to total

[10] See Local Competition Order ¶ 678.

forward-looking investment or expense, ensures that no more than total forward-looking wholesale expense will be recovered in element rates.

D. Particular Issues Related To Determination of Investments

Q. In general, how are network-element investments determined?

A. The determination of such investments starts with the relevant materials costs. These costs are divided by utilization factors to develop materials cost per unit of the element in service. Finally, investment "loadings" are applied to determine the associated engineering, installation, power, and land and building costs associated with the material investment.

1. Material Investments

Q. How did Verizon MA determine the relevant material investments?

A. Switching materials investments were obtained from standard models developed by Telcordia, as described in more detail below. Investments for other elements were generally determined from Verizon MA's Engineering and Construction Records Information System ("ECRIS"), or from the vendor. In each case, however, the investments are based on, and fully reflect, the latest negotiated

vendor prices (inclusive of all discounts) currently available to Verizon MA.

2. Utilization Factors

Q. What is a utilization factor?

A. The utilization of a particular facility is an "estimate of the proportion of [the] facility that will be 'filled' with network usage."[11] Utilization has an impact on cost, since the total cost of a facility must be allocated over those units of service (*e.g.*, subscribers, access lines, or minutes of use) that are actually "handled" by the facility in question and that are thus available to generate revenue if those costs are to be recovered.[12] Thus, the smaller the number of units that are actually handled by the facility (*i.e.*, the lower the utilization), the greater is the fraction of the cost of the facility that must be assigned to each unit.

Q. What are the factors that affect the utilization of network capacity?

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[11] *Local Competition Order* ¶ 682.

[12] *See* LCO ¶ 682: "Per-unit costs shall be derived from total costs using reasonably accurate 'fill factors' . . .; that is, the per-unit costs associated with a particular element must be derived from dividing the total cost associated with the element by a reasonable projection of the actual total usage of the element." *See also* 47 C.F.R. § 51.511.

A. Network elements and systems cannot be engineered to operate at 100 percent utilization. Forecast uncertainties, customer inward-outward movement, random fluctuations in demand, future growth, maintenance requirements, and other factors make it impractical and inefficient to allow elements to be completely utilized to meet the current network demand. A margin of unused capacity, usually called the "administrative spare," is included in engineering capacity planning to accommodate some of these factors. Although at times some of this spare is temporarily activated in response to one of these needs, on average this capacity is left unused. For this reason, the highest theoretical average utilization that an elements or system can reach is the total capacity less the administrative spare. This highest theoretical utilization, however, does not determine the actual average utilization level of an efficiently designed network. As described below, other factors are also relevant:

Demand growth. Network demand grows at a gradual rate. New network capacity must be provided in anticipation of this growth. Network additions, however, must be placed in efficient increments depending on the technical characteristics of the system and the cost of the installation. Too small an addition will mean that the potentially

expensive construction or other work associated with additions will have to be carried out too often. Too large an addition will mean that utilization will be unnecessarily low over the facility's life cycle. Engineering judgment must be applied to determine appropriate augmentation intervals — and amounts — for each type of network facility.

At any point in time, some network systems will have just had a capacity addition, while others will be approaching exhaust. Across the whole inventory of network systems it is reasonable to expect that systems will be randomly distributed across this utilization continuum.

Customer Churn. Customer outward/inward movement also affects utilization. Much of this outward/inward movement yields no net gain in lines and is referred to as "churn." For example, a customer moves out of a location and a new customer does not move into that location for some time. The time between disconnect and reconnect varies, but will always result in some idle time that will lower effective utilization levels. Switch ports, loop feeder plant, loop distribution plant, and interoffice facilities are examples of network components significantly impacted by churn.

Increasing levels of local competition should increase customer churn and further reduce the average utilization of network capacity in the future.

Breakage. The practical utilization level that can be achieved is also affected by "breakage." This term refers to the fact that many network components come in a limited set of capacity units. The simplest example is copper or fiber cable. Large fiber cable is manufactured in units of 12 fibers and not all possible multiples of 12 are provided. Copper cable normally comes in specific multiples of 100 pairs. Actual demand rarely conforms neatly to the available units of capacity. The difference between the developed engineering requirement and the actual size of the unit that must be placed is referred to as "breakage."

Technological churn. Technology evolution also affects the utilization experienced in any real operating network. Every technology is the "forward looking" choice only for a limited period of time. The accelerating pace of technology change has consistently reduced this period in recent years. For example, new generations of SONET systems have become available in recent years. In many instances, it becomes economic to install additional network capacity

with the latest technology and thus to leave unutilized a portion of the facilities based on the older technology. This process facilitates the evolution of network technology and reduces the life cycle cost of network capacity. It also, however, reduces the average utilization experienced in real operating networks.

Q. How were the utilization factors used in these cost studies determined?

A. Because the forward-looking TELRIC network does not yet exist, the utilization factors, like every other aspect of the construct, must be estimated by applying past experience to the forward-looking network technology model. In some cases, the utilization factors used in this study were determined by starting with the theoretically highest administrative spare margins and adjusting these downward to reflect the factors just described. In other cases, based on the judgement of the Company's engineers, it was determined that the current actual utilization would be an appropriate starting basis for estimating the forward-looking construct. The Department agreed with this approach in the Consolidated Arbitrations when it stated that "there is no reason to believe that the same set of drivers that exist today when NYNEX plans its own network would not exist in a situation

where it is the 'firm' building unbundled network elements under the TELRIC framework"[13].

The calculation of utilization factors for specific elements will be described in the sections of the testimony devoted to those elements.

3. Investment Loadings

Q. What are Investment Loading Factors?

A. All of the investments used in Verizon MA's cost studies presented here reflect the total cost installed ("TCI") of the necessary facilities and equipment, including required support investment. The Company uses investment loading factors in order to translate investments based solely on materials prices into TCIs.

Q. Which investment loading factors are used in the Company's studies?

A. The Company has developed Engineer, Furnish & Install ("EF&I"), Land and Building ("L&B"), and Power factors for use with digital switching, digital circuit and originating/terminating plant accounts.

Q. Are these factors used for all investments?

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[13] D.P.U 96-73/74, 96-75, 96-80/81, 96-83, 94-94- Phase 4, Order Dated December 4, 1996 at 32.

A. No. Certain investments, for example, those investments derived from the ECRIS database, as described in greater detail below, already include installation and engineering costs. Application of an EF&I factor is unnecessary for those investments. As explained earlier, investment loading factors are applied within the VCost system. VCost determines which loadings are applicable based on the plant account of the investment.

Q. What does the EF&I factor represent?

A. The EF&I factor translates a material-only investment into an installed investment, including such items as vendor engineering, Verizon MA engineering, transportation, warehousing, vendor installation, Verizon MA installation, and acceptance testing. Separate EF&I factors are developed by Field Reporting Code ("FRC") for the following classes of investment:

- Digital Circuit equipment (Subscriber Pair Gain – equipment at central office; Subscriber Pair-Gain – equipment at customer's premises; and other),
- Digital Switch, and
- SONET Circuit and other terminal equipment - CPE.

Q. How are the EF&I factors developed?

A. The factors are developed on the basis of the data contained within the Company's Detailed Continuing Property Record ("DCPR") database. Specifically, the total installed investment for hardwired equipment installed in calendar year 1998 was added to the plug-in equipment installed in calendar year 1998. (This was the latest year for which data were available at the time that the studies were done.) The sum of the installed investments was then divided by the sum of the material-only investments of the same equipment, also derived from DCPR. This yielded the final EF&I factor, which represents the relationship of TCI investment to materials investment for equipment in the future based on current relationships.

Q. Why is it appropriate to base these factors on current relationships?

A. In general, the relationship between material costs and total installed costs based on 1998 data are representative of the relationships that the Company expects to experience on a going-forward basis. This will not be the case, however, if one has to assume significant decreases in the price of equipment purchased in the future. If as a result of projected increased discounts offered by vendors, the percentage discount applied to the material price is assumed to be significantly higher in the future than what the Company initially has

used in the cost studies, an adjustment would be necessary. This is because the amount of time required to engineer or install the equipment would not change simply because the price of the equipment is reduced. As a result, an adjustment would be necessary to ensure that a factor applied to a lower material investment will still yield the correct identification of engineering and installation work.

Q. How would such an adjustment be calculated?

A. The adjustment would be calculated on the basis of the average discount initially used in the cost study and the forward-looking discount to be assumed in the material price studies. The material investment underlying the original factor development would be recast with the higher forward-looking discount level on, and the factor is recalculated using the original engineering and installation costs, but the recast material investment.

Q. Are the EF&I factors specific to Massachusetts?

A. No. The factors have been developed on a regional (*i.e.*, Verizon-East-wide) basis. This is being done throughout the Verizon footprint to reflect more accurately how the costs are incurred. Certain investments, for example Service Management Systems, may be

installed in one state to serve multiple jurisdictions. Additionally, not all types of investments are placed in each state during a given calendar year. Therefore, a regional approach ensures that all relevant investments are included in the EF&I loadings.

Q. What does the L&B loading factor represent?

A. The L&B factor identifies an amount of land and building investment that is required to support equipment housed in central offices ("COs"). A separate L&B factor is developed by FRC for:

- Digital Circuit equipment (Subscriber Pair Gain – equipment at central office and Other), and
- Digital Switch.

Q. How were the factors developed?

A. The factors were developed on the basis of the data reported in the Company's Financial Reports, specifically its A-817 reports. The steps were as follows:

- The total telephone plant in service ("TPIS") balances as of the year ending December 1999 for land and buildings were determined.
- Building investments associated with collocation were subtracted out, in order to avoid any double-counts with respect to investments included in collocation rates.
- A factor based on Separations data, representing the portion of land, buildings, capital leases and leasehold improvements that is associated with central office equipment, was then

applied to yield the assignable Central Office Equipment L&B investments.

- Investments in the electronic switching, operator systems, and circuit accounts were brought to forward-looking levels with the application of a forward-looking-to-current ("FLC") ratio, as explained below. These Central Office Equipment accounts were then added.

- The assignable Central Office Equipment L&B investments were then divided by the sum of the central office equipment accounts. The resulting factor was split between a land factor and a building factor on the basis of the investments in land and building relative to each other.

Q. Are the land and building factors specific to Massachusetts?

A. Yes. The building factors are developed on a state-specific basis, since that most accurately reflects the current relationship between the central office L&B investments in a given state and the central office equipment investments that they support.

Q. What do the Power factors represent?

A. The Power factors represent a relationship between the amount of power investment necessary to support specific central office equipment and the investment in the equipment itself. Separate factors are developed for Digital Switch and Digital Circuit (both for subscriber pair-gain placed in central offices and other equipment).

Q. How were the power factors developed?

A. The factors were developed on the basis of the data contained within the DCPR database. The installed investment of power equipment placed in 1998 was identified by the type of equipment it is supporting. Next, the total installed investment for hardwired central office equipment installed in calendar year 1998 was added to the central office plug-in equipment installed in calendar year 1998. The sum of the installed central office investments was then divided into the installed investment of power equipment to yield the relevant power factors.

Q. Are the power factors specific to Massachusetts?

A. No. The factors were developed on a regional basis. This was done because for a given plant account, there can be relatively large variations from year to year in the amount of equipment being placed in any given state. However, the amount placed yearly across the footprint has less variability. As a result, in order to smooth out any anomalies while still maintaining the most up-to-date relationships, the factors were calculated on a region-wide basis rather than on a state-specific basis.

E. DEAVERAGING: GENERAL ISSUES

Q. To what extent is Verizon MA required to deaverage its rates for the network elements considered in this filing?

A. The FCC's TELRIC regulations require states to "establish different rates for elements in at least three defined geographic areas within the state to reflect geographic cost differences[14].

Q. Do Verizon MA's rates currently comply with the deaveraging requirements?

A. Yes. In the Consolidated Arbitrations, the Department determined that the appropriate number of zones for the state of Massachusetts is four. The Metropolitan zone consists of the four wire centers located in downtown Boston. Each of the remaining zones (Urban, Suburban, Rural) is determined based on access line density (Access lines per square mile). Current data supports the continued use of the four zone approach based on access line density.

Q. For what elements will the rates differ between the zones?

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[14] 47 C.F.R. § 51.507(f)

A. Verizon MA is proposing different zone-based rates only for loops (and certain subloop components). For reasons discussed below, it is not appropriate to develop deaveraged rates for other elements.

F. ANNUAL COST FACTORS

1. Introduction

Q. What is an Annual Cost Factor?

A. The previous sections of this testimony explained how Verizon MA, through the use of the initial material investment and investment loadings, developed a total installed investment. Annual Cost Factors ("ACFs") are used to translate this total investment into annual costs for UNEs. ACFs are ratios that represent relationships between a subset of expenses and (1) their associated plant account investments, (2) relevant expenses or (3) total revenues. The ACFs based on expense-to-investment ratios ("ACF_{EI}") are used to estimate the level of annual expense that the Company can expect to incur to provide a particular network element based on the investment of the element. The ACF based on expense-to-expense ratios is used to identify an allocation of Common Overhead ("ACF_{COH}"). The ACF based on an expense-to-revenue ratio identifies an assignment of